PART 01100 - WATER SUPPLY SYSTEMS

Delete Section 01120 Irrigation Systems in its entirety and replace with the following:

Section 01120 - Irrigation Systems

Description

01120.00 Scope - This work consists of furnishing and installing landscape irrigation equipment as shown on the Plans and as specified.

01120.01 Contractor's Qualifications - In order to install certain kinds of equipment or systems, specific certifications, license's, and experience will be required, as described below:

For irrigation work: A valid Oregon Landscape Contractors License for and a valid Oregon Landscape Business License are required. The irrigation work shall be performed by a firm specializing in irrigation work. The irrigation Contractor shall have at least two years prior experience on similar scope projects. Submit names, addresses, and dates of previous projects, and owners contact information, if requested by the Engineer.

For irrigation backflow prevention device work: For irrigation backflow preventer installations, a valid Oregon Landscape Contractors License for irrigation plus backflow or a valid Oregon Plumbing License is required.

For backflow prevention device testing: A valid Certified Backflow Assembly Tester certification from the State of Oregon is required.

For Rain Bird MAXICOM equipment installation: Ability to demonstrate knowledge and qualifications to install MAXICOM equipment.

01120.03 General – Ensure that the Work meets the following requirements:

(a) Coordination – Coordinate with other trades affecting and being affected by work of this section.

(b) Utility Locate – Coordinate all existing utility locations according to Section 00150. Verify the location of any underground utilities prior to beginning work and maintain locate marks throughout construction.

(c) Protection – Preserve and protect existing improvements and vegetation in areas to remain undisturbed for duration of project. Return to condition found if damaged.

- Preserve and protect survey monuments, bench marks, and other reference points. If disturbed, or destroyed, replace as directed and at no expense to the Owner.
- Preserve and protect active utilities and maintain in continuous operation for duration of project. Repair or replace all damage to known utilities at no expense to the Owner.
- Protect persons and property from damage and discomfort caused by dust. Water as necessary or when directed.
- Use all means necessary to protect materials and work of this Section and all other Sections before, during, and after installation. In the event of damage, immediately make all repairs and replacements as directed by Owner's Representative.

(d) Weather Conditions - Temperature of pipe mating surfaces to be between 40 degrees Fahrenheit and 100 degrees Fahrenheit. Do no PVC solvent welding in rainy weather, except under cover.

01120.03 Inspections:

(a) Notice for Required Inspections - Notify the Engineer a minimum of 24 hours prior to any required inspection. Inspections on weekends and holidays will be performed at the discretion of the Engineer.

(b) Required Inspections - The following inspections will be required at a minimum:

- Upon completion of layout and flagging, prior to commencement of excavation or installation work.
- Upon completion of the main line and control wires, with all valves installed, prior to backfilling.
- At start and end of mainline pressure test.
- Upon completion of lateral piping, prior to backfilling.
- After forming but prior to pouring concrete bases for controller cabinets.
- Upon completion of the entire system, at which time the system will be reviewed, and a punch-list generated if required.

- Upon completion of the punch-list work, at which time the system will be accepted, provided that the system is in first-class operating condition, and provided that the Contractor has complied with all other terms of the Contract.

Make any corrections identified at each review prior to proceeding with additional work.

01120.04 Submittals:

(a) The following shall be submitted within 45 days after award of Contract:

(1) Product Data. Submit a list of proposed materials for approval before arranging for procurement of any materials. If any initially proposed materials are not approved, submit substitutes for approval. Any materials installed without approval will be subject to removal and replacement with acceptable material at the Contractor's expense. Include all material to be used showing manufacturer's name, catalog numbers, catalog cuts, technical data, and manufacturer's installation, operation, and maintenance instructions for each product.

(2) Test Reports. Verify meter location, size, PSI, and GPM. Conduct flow test to verify GPM. Submit results of test to the Engineer.

(b) The following shall be maintained during the work and submitted after completion of work and prior to issuance of the Third Notification:

(1) Record Drawings - Contractor shall maintain a current and legible set of irrigation plans in a safe and accessible location on site at all times for review by Engineer or inspector. Design changes and actual locations of pipe and valves shall be noted on the plans daily as the irrigation system is constructed.

- Indicate two dimensions for all valves (including quick couplers and drain valves) and stub-outs.
- Indicate approximate locations and route changes to mainline piping, lateral line piping, and head layout.
- Submit record drawings to Engineer for approval.

(2) Owner's copy of Backflow Prevention Device test report**.**

(3) PE-39 wire splice kit, if Flow Sensor is shown for installation.

(4) Spare nozzles in standard irrigation nozzle trees, if rotor heads are shown for installation.

01120.05 Warranty - Warranty all material and work for one year after date of the Third Notification. Correct immediately any failure caused by poor material or workmanship during warranty period. "Immediately" shall mean within 72 hours, as determined by the City depending upon the immediacy of the needed repair. City will proceed with repairs and bill Contractor for costs and any damages when Contractor fails to comply.

Materials

01120.10 General - Furnish only commercial quality materials and equipment. All items proposed for use will be subject to testing to ensure compliance with the Specifications. Provide materials of the same function that are of the same type and the same manufacturer.

- Use only new materials.
- Protect against damage.
- Store packaged materials in manufacturer's original container with legible labels intact.
- Store plastic pipe on firm, level support; protect against direct sunlight.
- Store plastic pipe cement at room temperature or as recommended by manufacturer.

All items proposed for use will be subject to testing to ensure compliance with the Specifications.

01120.11 Pipe, Tubing, and Fittings - Furnish galvanized iron or steel, PVC, or polyethylene pipe as shown or specified that meets the following requirements:

(a) Main & Lateral Line Pipe: PVC (Polyvinyl Chloride) Type I, NSF approved as per ASTM-D1784, D- 1785, and US Product Standard PS 21-70, 22-70. All PVC pipe shall be continuously marked with manufacturer's name, kind of pipe, material, IPS, class, or schedule. All pipe shall be Schedule 40 with solvent-weld connection fittings unless otherwise noted on Plans.

(b) Sleeves: PVC (Polyvinyl Chloride) Type I, NSF approved as per ASTM-D1784, D-1785, and US Product Standard PS 21-70, 22-70. All PVC pipe shall be continuously marked with manufacturer's name, kind of pipe, material, IPS, class, or schedule. All pipe shall be Schedule 40 with solvent- weld connection fittings unless otherwise noted on Plans.

(c) Fittings: PVC (Polyvinyl Chloride) Type I, white Schedule 40 and grey Schedule 80, approved as per ASTM D-1784, ASTM D-2466, and ASTM-D2467 or ASTM-D2464, as applicable. All PVC fittings shall be marked with manufacturer's name, kind of pipe, material, IPS, class, or schedule.

(d) Drip Irrigation: Makes and models shown on the Plans or approved equal. Only use fittings of the same manufacturer as the emission devices.

(e) Backflow Preventer Vault Drainline: Two inch PVC or approved.

(f) Swing Joints:

(1) Spray heads: 12" minimum, 36" maximum polyethylene swing pipe ("funny pipe") with spiral barb 90 degree ells at both ends, and marlex ell below the irrigation head sized to fit head inlet. See detail. Or approved equal.

(2) Rotor heads: Swing joint risers as detailed, with two Schedule 80 nipples, two Schedule 40 st. ells, and one Schedule 40 TxT ell. Swing pipe, snap, and "funny pipe" risers not allowed. Or approved equal.

(g) No galvanized pipe or fittings may be used.

(h) Non-Potable Colored Coded Pipe - Wherever non-potable, reclaimed or reuse water is used, furnish PVC pipe that is tinted purple and imprinted with the warning "Caution: Reclaimed Water - Do Not Drink". Provide pipe meeting the same AWWA and ASTM specifications as the potable water pipe sizes on which they are based.

01120.12 PVC Cleaner and Primer - R. G. Sloan "Weld-on Purple P-70" or approved equal.

01120.13 PVC Solvent Cement - R. G. Sloan "Weld-on 711" or approved equal. The expiration date shall not be exceeded.

01120.14 Pipe Joint Tape - Teflon tape or approved on all threaded plastic joints. Minimum of 4 wraps. No pipe dope. Virgin Teflon paste may be used on brass threaded joints.

01120.15 Water Meter - Unless otherwise specified, water meter procurement, installation, and associated costs will be the responsibility of the Agency.

01120.16 Backflow Prevention Devices - Backflow prevention devices will be shown on the plans. Furnish and install backflow prevention devices meeting the requirements of the Oregon Health Division and the local water authority.

(a) 2" and under Wilkins "950XLT-SH." Size as shown on Plans.

(b) Over 2": Ames "2000SS". Size as shown on the Plans.

01120.17 Flow Sensor - Rain Bird "FS" series or Data Industrial "IR-250B/220P" series. Brass/ bronze at 1" size, PVC over 1" size. Size as shown on Plans.

01120.18 Valves

(a) Gate Valves: Nibco "T-113-BHW", or approved equal. Same size as Electric Remote Control Valves.

(b) Manual Drain Valves: USA manufactured 3/4" manual angle valve. All valves to have non-floating seat disk that allows positive drainage.

(c) Quick Coupling Valve: Rain Bird "44LRC". For non-potable water systems Rain Bird "44NP"

(d) Isolation Valves:

(1) 2" and under: Conbraco "Apollo 7B-10X-31", line size. Or approved equal.

(2) Over 2": Kennedy "KenSeal II Model No. 8561AN-SS", same size as mainline. Or approved equal.

(e) Electric Remote Control Valves: Rain Bird valves, models and sizes as shown on Plans.

(f) Electric Master Valve: Superior "Model #3100 Normally Open" electric valve. Size as shown on Plans.

01120.19 Valve Boxes and Lids

(a) Backflow Prevention Device: Carson #2436-18 with flush cover, bolted closed.

(b) Electric remote control valves, Isolation valve (2" and under), Electric master valve, Flow sensor: Carson #1419-12 with T-cover, two boxes per valve, bolted closed.

(c) Isolation valves (over 2"): Carson #910-10 with T-cover, bolted closed with 4" Class 160 PVC sleeve down to valve.

(d) Quick coupler: Carson #910-10 with T-cover, bolted closed.

(e) Drain valve: Carson #910-10 with T-cover, bolted closed.

- Or, Brooks equivalents.
- In traffic bearing situations use traffic bearing concrete or polymer concrete boxes and lids rated for AASHTO H-20 highway loading. Sizes equivalent to above.

01120.20 Irrigation Wire - Copper, #14 AWG minimum, UL listed, meeting requirements of ASTM B-3. Colors as follows:

(1) Electric Remote Control Valve - Common wires: White

(2) Electric Remote Control Valve - Control wires: Red

(3) Electric Master Valve wires: Black & Yellow (1 each)

(4) Spare wires: Red

01120.21 Wire Connectors - Scotch Lok "3570", 3M "DBY", or approved equal.

01120.22 Communication Wire - #19 AWG, solid copper conductor, twisted pairs. 3 pair minimum. The cable shall be polyethylene insulated, aluminum shielded, conforming to the requirements of REA Specification PE-39. Manufacturer's identification, pair count, conductor size, and year of manufacture shall be shown at 2' intervals on the outer jacket.

01120.23 Communication Wire Splice Kit - Preformed "Super Serviseal Closure" (Catalog No. 8006039), or approved equal.

01120.24 Detectable Marking Tape - Use detectable marking tape consisting of inert polyethylene plastic that is impervious to all known alkalis, acids, chemical reagents and solvents likely to be encountered in the soil, with a metallic foil core to provide the most positive detection by pipeline locators. Furnish color-coded tape with the type of line buried below and the word "Caution" imprinted continuously over its entire length in permanent black ink. Provide tape of the width recommended by the manufacturer for the depth of installation used.

01120.25 Tracer Wire - Copper, #18 AWG minimum, UL listed, Blue

01120.26 Sprinkler Heads - Makes and models shown on Plans.

01120.27 Automatic Controller Cabinet – Provide one or more of the following, as specified on the Plans:

(a) Type A: Hoffman Enclosure, Inc. "A-30R3012HCR"

(b) Type B: Hoffman Enclosure, Inc. "A-36R3612HCR"

(c) Type C: V.I.T. Products, Inc. "SB24SS/M-LMLC", all locks to be keyed RainBird.

01120.28 Conduit and Fittings

(a) Under ground: Sch. 40 grey PVC, Class III, Federal Specification W-C-1094.

(b) Above ground: Aluminum, Federal Specification WW-G-540.

(c) Conduits through walls shall be LB conduits.

(d) Sweep ells shall be minimum 24" radius.

01120.29 Grounding Equipment

(a) Ground Rods: UL listed 5/8" x 8' copper clad ground rod, with ground rod wire clamps as required.

(b) Ground Wire: #6 AWG solid, soft-annealed uncoated copper, conforming to UL standard 719.

01120.30 Bedding and Backfill Materials

(a) Mainline and Lateral Lines: Native on-site soil, free of rock and other deleterious materials. If rock or other deleterious materials are encountered, notify Owner's Representative, and use clean fill sand if directed.

(b) Sleeves: Bedding, pipe zone, and backfill shall conform to Section 00405.

(c) Drain and Sump Areas: ½" x ½" washed round rock.

(d) Impact pop-up type sprinkler heads only: ½" x ½" washed round rock.

Construction

01120.40 General - The irrigation plans are a schematic design and may require adjustment. Do not install the sprinkler system as shown if it is evident that obstructions, grade differences, or differences in area dimensions create conditions different than anticipated in the design. Bring all such obstructions or differences to the attention of the Engineer. In the event this notification is not performed before construction begins on a part of the system where discrepancies exist, any revisions necessary to make the system operate as designed will be the responsibility of the contractor at no additional expense to the agency.

(a) Existing Conditions - Verify that surfaces and structures to receive work specified herein are accurately sized and located, sound, secure, true, complete, and otherwise properly prepared.

Prior to starting work, notify General Contractor and Engineer of discrepancies or defects requiring correction.

Verify meter location, size, PSI, and GPM. Conduct flow test to verify GPM. Submit results of test to the Engineer.

Do not start work until conditions are satisfactory. Beginning of work in an area denotes that the Contractor accepts all conditions of that area and the ramifications thereof, with the exception of latent conditions.

(b) Plumbing - Install all parts of the irrigation system according to the Oregon Plumbing Code and State and local laws. Make water service connections as shown and specified. Conform to the requirements of the jurisdictional water authority. Ensure that water velocities in PVC pipe do not exceed 1.5 m/s (5 feet per second), unless approved in writing by the Agency. Bring any velocities exceeding 1.5 m/s (5 feet per second) created by pipe sizes shown on the plans to the attention of the Agency before beginning construction. Correct excess velocities existing after construction, or caused by changes from the plans, at the Contractor's expense, unless a written agreement has been made authorizing otherwise.

(b) Electrical Service - Install electrical service according to 00960.49, the National Electrical Code, and all State and local laws. Power sources will be as shown or as directed. Be responsible for coordination and installation of electrical service. Furnish and install meter bases at the power source conforming to the requirements as shown and specified. Give the power supplier's representative notice before making any installation. Provide a separate, dedicated circuit for the controller.

01120.41 Layout of Irrigation System - Stake the irrigation system, following the schematic design on the plans, before construction begins. With prior approval, make alterations and changes in the layout to conform to ground conditions and to obtain adequate coverage of water. Comply with the requirements of 00150.50.

System layout on Plans, including water mainline location, is diagrammatic and may not be exact. Center of irrigation symbol represents location. If field measurements differ slightly from drawing dimensions, modify work as required for accurate fit. If measurements differ substantially, notify Engineer prior to installation. Sprinkler spacing not to exceed dimensions on drawing.

Obtain Agency approval of layout prior to any excavation or installation work.

01120.42 Excavation - Unless otherwise approved, do not obstruct private or public streets, drives, or pedestrian walkways. Keep the top 6 inches of topsoil, if applicable, separate from subsoil and replace this topsoil as the top layer when backfilling within un-paved areas.

Irrigation Sleeves: Minimum width of trench to be 1 ½ times pipe outside pipe diameter. Width for open- cut trenches within existing or proposed Roadways and Shoulders shall conform to Section 00405.

Main and Lateral Lines: Minimum width of trench to be 1 ½ times pipe outside pipe diameter.

Exercise care when excavating near existing trees. Do not use mechanical trenchers with in Zone of Protection or Critical Root Zone of existing trees unless approved by the Project Arborist and Engineer. Any irrigation pipe installation activity within the Zone of Protection or CRZ shall be preformed under the supervision of the Project Arborist using tunneling or boring equipment, an air spade, or hand tools. When large roots are exposed, wrap them with heavy burlap for protection and to prevent excessive drying. If approved, when digging trenches by machine adjacent to trees having roots 2 inches and less in diameter, hand trim the sides of the trench, making a clean cut of the roots. Treat all cut and trimmed roots 1/2 inch or larger in diameter with an approved tree wound dressing. Backfill trenches having exposed tree roots within 24 hours unless protected by continuously moist burlap or canvas.

Excavate to allow for the following minimum cover depths:

- 24-inch for main lines and low voltage electrical wire running with main line pipe;
- 15-inch for lateral lines in shrub beds;
- 15-inch for lateral lines in lawn areas;
- 30-inch for low voltage electrical wire not running with main line pipe; and
- 30-inch for electrical wire.

More than one pipe is permitted in the same trench under the following conditions:

- 2 pipes may be stacked vertically if 4-inches of earth separates them;
- 3 or more pipes must be laid 4-inches apart horizontally in trench.

01120.43 Pulling Pipe - Pipe installation using a "pipe puller" may be approved if there is adequate topsoil depth and the topsoil is free of rock. Obtain the Engineer's approval before using a pipe puller. Include any resultant changes in material or design with the request for use of this method.

Pulled pipe depths shall comply with specified trenched pipe cover depths.

If unforeseen bedrock is encountered during excavation that prevents the pipe from being buried at the specified depth, immediately bring it to the attention of the Engineer.

01120.44 Excess Excavation - Backfill and compact excess excavation to form a trench that supports the pipe evenly.

01120.45 Pipe Bedding - Mainline and Lateral lines: Provide uniform bearing surface of native on-site soil, free of rock and other deleterious materials. Remove any rocks or other material that might damage pipe from the bottom of the trench. If rock or other deleterious materials are encountered, notify Owner's Representative prior to placing pipe, and bed pipe with 2" minimum of clean fill sand if directed. Maintain specified cover depth.

Sleeves: Conform to Section 00405.

01120.46 Sleeve Installation - Place all PVC pipe installed under pavement in pipe sleeves of Schedule 40 PVC, unless shown or specified. Provide under sidewalks and where shown on Plans as required to install irrigation system. Set sleeves at depth in accordance to trenched pipe depths. Solvent-weld sleeve sections. Extend sleeves a minimum of one-foot beyond sidewalks or other paving on each side. Run sleeves level and perpendicular to sidewalks, curbs, etc. and pavement unless shown otherwise on Plans. Provide visible markers where sleeve ends are concealed. Coordinate installation of sleeves with other trades.

01120.47 Backflow Prevention Device Installation:

(a) Double Check Valve Assembly (DCVA) - Install, inspect, and test the DCVA according to applicable regulations of the Oregon Health Division and the local water authority. Installation to be by licensed plumber or Landscape Contractor with backflow preventer installation license. Furnish test records on forms approved by the Oregon Health Division. Furnish forms filled out by a State-licensed Backflow Device Tester documenting that the DCVA is in good operating condition before any flushing and testing of downstream water lines. Repair or replace the DCVA whenever it is found to be defective. If shown, min. 2" daylight drain shall be bore sighted drain.

(b) Reduced-Pressure Backflow Device (RPBD) - Install, inspect, and test the RPBD according to the applicable portions of the Oregon Plumbing Code and applicable regulations of the Oregon Health Division and the local water authority. Installation to be by licensed plumber or Landscape Contractor with backflow preventer installation license. Apply the same specific testing requirements as stated for the DCVA above.

01120.48 Pipe Installation and Jointing:

(a) General - During construction, plug or cap pipe ends to prevent entry of dirt, rocks and other debris.

(b) PVC Pipe - Follow instructions in Uniform Plumbing Code, Section 802.1.5 and manufacturer's instructions. Snake pipe slightly to allow for pipe movement. Cut all pipe square and remove burrs. Chamfer all outside edges of pipe. Clean and dry ends of pipe to be joined. Apply liberal coat of primer solvent to both pieces of pipe to be joined. Immediately apply cement to both pieces of pipe to be joined using a light coat to inside of female fitting to prevent puddling inside pipe and fitting. Attach pipe while both surfaces are wet and hold together until pipe will not back out. Bottom the pipe into socket one-quarter turn while entering. Wipe excess solvent cement from outside of joint. Allow 24 hours before pressurizing pipe.

(c) Threaded Plastic Pipe - Thread with conventional equipment. Plug pipe ends during threading to prevent pipe distortion or damage. Do not use solvent cement on joints. Wrap joints with Teflon tape, minimum four wraps.

(d) Polyethylene Pipe - Install polyethylene pipe and fittings according to the manufacturer's recommendations. Cut the ends of the polyethylene pipe square and insert the fitting to its full depth.

01120.49 Flow Sensor Installation - Install at locations shown on the Plans and per the manufacturer's instructions. Ensure required pipe run distances on each side of the flow sensor are met.

01120.50 Valve Installation:

(a) Electric Master Valve - Install at locations as shown on the Plans and per the manufacturer's instructions.

(b) Isolation Valve - Install if shown and as detailed on Plans.

(c) Gate Valve and Electric Remote Control Valve - Install level and square, as detailed, and according to the manufacturer's recommendations. Ensure detailed clearance tolerances are met.

(d) Manual Drain Valve - Install only when shown and detailed on Plans.

(e) Quick-Coupling Valve - Install plumb and secure in valve box, with top of valve set 3-inches below top of box and grade. Place ½-inch open crushed rock in valve box to 1½-inches below top of valve. Support quick coupler by attaching 18" length #4 rebar with two stainless steel clamps each side. See detail.

01120.51 Valve Covers And Boxes Installation - Use only one valve per box unless otherwise approved. Set all valve boxes at grade of lawn or shrub mulch surface unless otherwise noted. Maintain minimum 15 inch coverage from finished grade to lateral pipe. Valve boxes must have a minimum of 24-square inches of bearing surfaces.

Install (2) boxes for each control valve. Set one upside down and attach to top box with stainless steel screws. Bed with 2" of sand. Use landscape fabric to cover holes in box around pipe. See detail.

When required add bricks or concrete blocks with at least 12-square inches each on either side of the valve to get 24-square inches. Ensure minimum additional 48-inches of wire above finished grade is coiled around ½-inch pipe in box. See detail.

01120.52 Low Voltage Electrical Installation:

(a) Control and Common Wire:

(1) General: Install wire in continuous runs with no splices, unless approved. Install wire beneath main line pipe and coil 18" extra wire at 100' intervals and at each turn to allow for contraction of wire. Bundle wire together at 5-foot intervals with plastic tape or similar. Ensure minimum additional 48-inches of wire above finished grade is coiled around ½-inch pipe in boxes and minimum 48-inches of wire inside automatic controller pedestal to allow connection of all equipment.

When it is necessary to run wire separate from the irrigation pipe, bundle wire, cover with 6” fill sand, and place detectable marking tape over sand cover prior to backfilling.

Connect Electric Remote Control Valves and Master Valve to control and common wires using wire connectors. Connect controller end of wires to the locations identified on the City installed terminal strip at the controller location. Ensure all zones are operational.

The wiring may share a common neutral. When more than one automatic controller is required, provide a separate common neutral for each controller and the automatic valves it controls. Run separate control conductors from the automatic controller to each valve.

(2) Spare wires: Install spare wires from inside the automatic controller pedestal location to the furthest end of each mainline run. Loop spare wires into each valve box, or center valve box if a cluster of valves. Ensure minimum additional 48-inches of wire (to center of loop) above finished grade is coiled around ½-inch pipe in boxes. Install wire connectors at the end of spare wires.

(3) Splices: If approved, make all splices in a valve box and note these on record drawing. Provide an extra 48” of each wire coiled at each approved splice to allow for contraction of wire due to temperature or settlement of backfill.

(b) Communication Wire - Install communication wire in continuous runs with no splices from flow sensor valve box to automatic controller pedestal location and as shown on Plans. Install wire beneath main line pipe. Ensure all wires are operational.

Ensure minimum additional 48-inches of wire above finished grade is available in flow sensor valve box and minimum additional 48-inches of wire is inside the automatic controller pedestal to allow connection of all equipment.

Furnish communication wire splice kit to Agency.

(c) Tracer Wire - The Contractor shall place specified tracer wire below the pipe to allow for location and marking of all otherwise un-locatable buried pipe containing pressurized water. Tracer wire shall be continuous without splices unless approved prior to the work.

Tracer wire shall be extended into meter and valve boxes and shall wrap around fixture with sufficient length to extend 48" above finish grade. Ensure all wires are operational.

If approved, splices in tracer wire shall be insulated and waterproofed using specified wire connectors. All splice locations shall be approved by the Engineer. Tape wrapped around splices will not be accepted as waterproofing. Note splice locations on record drawing.

01120.53 Swing Joint Assembly - See details. Use on all heads unless otherwise noted.

01120.54 Sprinkler Head Installation - Install heads drip-tight and in locations shown on Plans. Install all heads plumb, or perpendicular to existing grade. Compact earth under pipe at sprinkler heads to prevent settlement from pulling sprinklers below grade.

Install at center of symbol of Plans, except as follows:

- Do not install any sprinkler body that is next to a sidewalk, curb, header, etc. higher than the top surface of the sidewalk or curb and leave 2" to 3" space from sprinkler rim to curb, etc.
- Set part circle sprinkler heads next to buildings 10 to 12-inches out from building.

Set head elevations as follows:

- In turf areas, set top of sprinkler flush with top of turf mat, or ½-inch above earth grade, whichever is higher.
- In shrub beds, set heads 3" above soil level and flush with final mulch grade.

01120.55 Drip Irrigation Installation - Install as shown on the Plans and per manufacturer's instructions. Flush lateral line thoroughly prior to and regularly during installation. Ensure all connections are tight and leak-proof.

01120.56 Automatic Controller Pedestal Installation - Follow manufacturer's directions.

Coordinate final pedestal location with Agency prior to excavation or installation work.

Trench for conduits as shown and detailed. Ensure specified conduit coverage depth can be met once conduits are installed.

Excavate and form footing as detailed.

Obtain Engineer's approval of forming prior to pouring concrete.

Provide broom finish on pedestal footing. Ensure all excess concrete is removed from the mounting surface of the pedestal. Provide a clean, smooth surface around j-bolts and pedestal mounting area. Footing shall have a maximum 1/8" deviation from level and flatness across top mounting surface.

Furnish and install specified Automatic Controller Pedestal true, plumb, and secure.

01120.57 Flushing and Testing:

(a) General - Provide gauges used in the testing of water pressures that are certified correct by an independent testing laboratory immediately before use on the Project. Retest gauges when directed.

(b) Main Line Flushing - To remove debris that may have entered the line during construction, flush main supply lines twice with the supply valve fully open. Flush first before placing valves and again after placing valves and before pressure testing.

(c) Main Line Testing - Allow minimum 24 hours after gluing before pressurizing pipe. Ensure all associated components of the mainline (backflow device, isolation valves, gate valves, electric remote control valves, quick-couplers, etc.) are installed prior to conducting test. Test after installing and before backfilling the main line. Ensure gate valves are open and pressure test is up to and against the electric remote control valves. The down stream side of the electric remote control valves shall not be capped. Purge all main supply lines of air and test with static water pressure of 100 psi minimum pressure for at least 24 hours without leaks, pressure loss or introduction of additional service or pumping pressure.

If initial 100 psi static water pressure is unobtainable with the static pressure available from the service meter, and with approval from Project Manager, additional initial pressure may be introduced to the system with use of hydrostatic test pump.

Call for inspection at beginning and end of this period. Test with one pressure gauge installed on the line where directed. Install an additional pressure gauge at the pump when directed. Correct rejected installations and retest for leaks.

(d) Lateral Line Flushing - Flush all lateral lines once with the supply valve fully open prior to placement of sprinkler heads, emitters and drain valves. Flush long enough to remove any debris that enters the lateral lines during construction. Cap risers immediately after flushing. Thoroughly flush lateral lines prior to and regularly during drip irrigation installation.

(e) Lateral Line Testing – Lateral lines will be tested by visual inspection before burial. Lines that have obvious leaks will be rejected. Correct all faults.

(f) Sprinkler Head Flushing - Flush all sprinkler heads as recommended by the manufacturer.

(g) Sprinkler Head Testing - Test for leaks in heads and connections and correct as required.

(h) Drip Line Flushing - Thoroughly flush drip lines regularly during drip irrigation installation.

(i) Drip Lines and Micro Tubing Testing - Drip lines and micro tubing will be tested by visual inspection while operating and before burial. Tubing that has obvious leaks or that doesn't operate as designed will be rejected. To fully test micro tubing, a water collection procedure recommended by the manufacturer may be required. Correct all faults before retesting.

01120.58 Backfill - Do not start backfill until all piping has been inspected, tested and approved. Complete backfilling as soon as possible after approval. Remove all scrap pipe, garbage, and other deleterious material and debris from trenches.

All backfill within 4-inches of pipe shall be free of any rock or debris which might mar the pipe. If rock or other deleterious materials are encountered, notify Owner's Representative prior to backfilling, and backfill pipe with 2" minimum width of fill sand on sides of pipe and/or wire and 4" of fill sand on top of pipe if directed.

Backfill for the first 12" above electrical service lateral conduit shall be fill sand.

Backfill from the bottom of the trench to approximately 6 inches above the pipe with continuous compaction in a manner that will not damage the pipe or wiring, and proceed evenly on both sides of the pipe. Thoroughly compact the remainder of the backfill without using heavy equipment within 18 inches of any pipe. Ensure that the top 6 inches of the backfill is topsoil material or, if suitable, is the first 6 inches of material removed in the excavation. Do all backfilling necessary to bring all surfaces to finished grades. Dispose of excess excavation as directed by Engineer. Refill trenches that have settled with imported soil to bring them flush with the surrounding grades.

Backfilling for all sleeves shall conform to Section 00405.

01120.59 Adjusting System - Before final inspection, adjust and balance all sprinklers to provide adequate and uniform coverage. Balance spray patterns by adjusting individual sprinkler heads by replacing nozzles to produce a uniform pattern. Unless otherwise specified, water spray will not be permitted on pavement, walks, or structures. Adjust pressure regulation components, if shown, for optimum operating pressure for the site conditions. Demonstrate to the Engineer that the system is in proper operating condition.

Finishing and Cleaning Up

01120.60 Record Drawing Plans and System Orientation - Upon completion of the work, submit corrected working drawings, schematic circuit diagrams, or other drawings necessary for the Engineer to prepare corrected plans showing the work as constructed.

01120.61 Restoration - Return all disturbed areas to original condition after installation is completed. Replant or replace any materials removed or disturbed during construction.

01120.62 Site Clean-Up - Keep the premises reasonably free from accumulation of debris. Maintain a safe clean work area throughout the project.

Remove all debris, equipment and surplus materials, and leave the premises in a neat and orderly condition at the completion of the work.

Clean all walks, streets, etc., affected by the work. Pressure wash or otherwise remove tire tracks and other ground-in soil contamination on walks and other hardscape.

01120.63 Product Cleaning and Repairing - Clean, repair, and touch-up or replace when directed, products (including work of other Sections) which have been soiled or damaged by work of this Section.

Operation and Maintenance

01120.70 System Operation - Repair, flush and test all main and lateral lines that sustain a break or disruption of service. Upon restoration of the water service, bring the affected lines up to operating pressure. After pressurizing, conduct a thorough inspection of all sprinkler heads, emitters, and other fittings, located downstream of the break or disruption of service, and repair. This inspection is required to ensure that the entire irrigation system is operating properly.

Completely install and test the irrigation system, and make it automatically operable before planting in an area except where otherwise shown, specified, or approved. Be fully responsible for all maintenance, repair, testing, inspection and automatic operation of the entire system until all work is complete and approved.

If Contract includes a 'Plant Establishment Period' operation and maintenance of the irrigation system shall be considered incidental to the Plant Establishment Period work. Operation and Maintenance of the irrigation system shall be for the duration of the Plant Establishment Period as specified in section 01040.

Operation and Maintenance shall include:

- Irrigation operation scheduling as required to sufficiently promote plant growth.
- Monitoring and maintaining irrigation system in a first-class working condition. This includes resetting of settled heads, ensuring heads and nozzles are clear and operating properly, and adjusting valves, heads, and operation times as required.
- Winterization of irrigation system no later than October 15 unless otherwise agreed upon. Winterization work includes:
    1. Close master Isolation Valve.
    2. Turn both isolation/ ball valves on Backflow Prevention Device to 45 degree angle. If gate valves are present at Backflow Prevention Device turn valves down two turns.
    3. Backflow Prevention Device test cocks: Remove brass caps, open and drain device, leave test cocks at 45 degree angle, reattach brass caps loosely on test cocks 1,2, and 3; leave cap off on test cock 4.
    4. If battery operated controllers are present remove batteries.
- Spring Turn-on of irrigation system. This includes de-winterizing the Backflow Prevention Device, re-pressurizing mainline, and walkthrough and adjustment of system to ensure all components are operating as required.

- Annual Backflow Prevention Device test. Test shall be completed at the end of each Plant Establishment Period and as specified in 01120.47. Submit a copy of Backflow Prevention Device test report to Engineer.

Measurement

01120.80 Measurement - No measurement of quantities will be made for work performed done under this Section.

Payment

01120.90 General - Payment will be made at the Contract lump sum amount for the pay item "Irrigation System", which will be payment in full for furnishing and placing all materials, equipment, labor, and Incidentals necessary to complete the work, including excavation and backfill, electrical service and system orientation.

All fill sand used for bedding and cover, unless listed separately on the bid schedule, shall be considered incidental to the lump sum bid item.

Operation and Maintenance – If the Contract includes a Plant Establishment Period, operation and maintenance of the irrigation system is incidental to the Plant Establishment Period and no separate payment will be made.

Section 01140 - Potable Water Pipe and Fittings

Description

01140.00 Scope - This work consists of constructing potable water pipe and fittings 16 inches and smaller in diameter within a public Right-of-Way or easement.

Materials

01140.10 Materials - Furnish materials meeting the following requirements:

Bolted, Sleeve-Type Couplings for Plain End Pipe	02475.60
Commercial Grade Concrete in Thrust Blocks	00440
Detectable Marking Tape and Wire	02470.60
Ductile Iron Pipe Fittings	02475.20
Ductile Iron Pipe	02470.20
Polyethylene Encasement	02470.50
Polyvinyl Chloride (PVC) Pipe fittings - 4" and larger	02475.40
Polyvinyl Chloride (PVC) Pipe fittings - under 4"	02475.45
Polyvinyl Chloride (PVC) Pipe - 4" and larger	02470.40
Polyvinyl Chloride (PVC) Pipe - under 4"	02470.45
Reinforcement	00530
Restrained Joints	02475.50
Steel Pipe Fittings - 6" and larger	02475.30
Steel Pipe Fittings - under 6"	02475.35
Steel Pipe - 6" and larger	02470.30
Steel Pipe - under 6"	02470.35
Tie Rods	02485.60

01140.11 Handling Pipe and Fittings - Handle pipe and fittings to prevent damage or contamination to the pipe, fitting, lining, or coating. Load and unload pipe and fittings using hoists and slings so as to avoid shock or damage, and under no circumstances allow them to be dropped, skidded, or rolled against other pipe or fittings. If any part of the coating or lining is damaged, repair in a manner satisfactory to the Engineer. Damaged or contaminated pipe and fittings will be rejected. Immediately separate all damaged or contaminated pipe and fittings and remove from the job site.

(a) Thread Protection - Protect threaded pipe ends with couplings or other means until laid. Inspect the pipe and fittings for defects.

(b) Temporary Storage - Store pipe on cradles to prevent entry of dirt, other foreign material, or contamination. Keep the pipe or pipe joint free of dirt, other foreign material, or contamination during handling or laying operations. Remove, clean, and relay any pipe or fitting that has been installed with dirt, foreign material, or contamination in it. At times when pipe laying is not in progress, close the open ends of pipe with watertight plugs or by other approved means to ensure cleanliness.

01140.12 Cutting Pipe:

(a) General - Use short lengths of pipe supplied by the manufacturer whenever possible to provide the proper spacing of valves, tees or special fittings.

(b) Cutting Operation - Cut pipe with abrasive saws or by special pipe cutters. Square all pipe ends with the longitudinal axis of the pipe. Ream and otherwise smooth the cut ends so that

good connections can be made. Cut threads cleanly. Flame cutting of ductile iron pipe will not be allowed.

Construction

01140.40 Trench Work - Excavate trench, prepare bedding, install pipe zone material, backfill, and dispose of excavated material according to Section 00405 and the following:

(a) Dewatering Trenches - Remove water encountered in the trench during pipe laying operations and maintain the trench until the ends of the pipe are sealed and provision is made to prevent floating of the pipe. Do not allow trench water or other deleterious materials to enter the pipe at any time.

(b) Bedding and Pipe Zone - For the purpose of these Specifications, all potable water pipes are considered flexible pipes. Use bedding and pipe zone material for flexible pipes as described in 00405.12 and 00405.13.

(c) Extra Trench Excavation - Changes in the alignments or grades of the potable water pipes from those shown or specified may be necessary because of unplotted utilities, or for other reasons. If directed to adjust, correct, relocate, or in any way change the line and grade, make such changes according to these Specifications.

(d) Grade and Alignment Changes - When pipeline grade is lowered in excess of 12 inches below the grade shown, or when pipeline horizontal alignment is changed by more than 12 inches after the original trench has been excavated, the additional excavation and backfill so required will be classified as extra trench excavation. The additional backfill material shall match the class used in the original trench.

(e) Installation in Paved Areas - If pipe is installed within paved areas to be preserved, perform the installation according to Sections 00405 and 00495.

01140.41 Laying Pipe:

(a) General - Lay pipe to the lines and grades shown and established.

(b) Ductile Iron Pipe - Install ductile iron pipe according to AWWA C600 and the manufacturer's recommendations.

(1) Curves - Lay long radius curves, either horizontal or vertical, with standard pipe by deflecting the joints. If the pipe is shown curved in the plans and no special fittings are shown, assume that the curves can be made by deflecting the joints with standard lengths of pipe. If shorter lengths are required, the plans will indicate maximum lengths that can be used. Do not exceed 80 percent of the manufacturer's printed recommendations for the amount of deflection at each pipe joint when pipe is laid on a horizontal or vertical curve. Where field conditions require deflection or curves not anticipated by the plans, the Engineer will determine the methods to be used.

(2) Pipe Laying Procedure - When ductile iron pipe is laid on a curve, join the pipe in a straight alignment and then deflect it to the curved alignment. On approval, make trenches wider on curves for this purpose.

(c) Polyethylene Encasement - Where shown, lay ductile iron pipe with a polyethylene encasement. Install polyethylene encasement according to AWWA C105 and the manufacturer's recommendations.

(d) Steel Pipe - Install steel pipe according to the manufacturer's recommendations. Lay steel pipe on curves in the same manner described above for ductile iron pipe.

(e) Polyvinyl Chloride Pipe - Install polyvinyl chloride (PVC) pipe according to AWWA C605 and the manufacturer's recommendations.

(1) Bends - Bend PVC pipe 12 inches and smaller to allow for slight changes in direction. The minimum bending radius shall be according to AWWA C605. Axial deflection at the pipe joints will not be allowed.

(2) Large Diameter Pipe - For 14 inch and 16 inch diameter pipe, accomplish slight changes in direction by axial deflection of the pipe joint not to exceed 80 percent of the manufacturer's recommendation. Use fittings for joint deflections greater than 80 percent of the manufacturer's recommendation.

(f) Water and Sanitary Sewer Separation - Comply with OAR 333 regulations governing horizontal and vertical separation between water and sanitary sewer facilities for installation of new water lines and appurtenances. Submit any proposal for variance in writing. Include in the proposal the reason for the variance, type of material and condition of the sewer line, location of the water and sewer facilities, horizontal and vertical skin-to-skin clearances and the corrective measures proposed. The proposal will be reviewed and approved by the Engineer. Each variance will be addressed in a case-by-case basis.

01140.42 Jointing Pipe:

(a) General - Clean all parts of the pipe ends, couplings, fittings, and appurtenances to remove oil, grit, or other foreign matter from the joint. Keep the joint from contacting the ground. When assembling gasketed joints, apply an approved lubricant as specified by the pipe manufacturer.

Mark pipe not furnished with a depth mark before joint assembly.

(b) Steel Pipe Under 6 Inches - Brush-coat exposed threads after jointing with an approved asphalt coating.

01140.43 Polyethylene Encasement:

(a) Installation - Install polyethylene encasement according to AWWA C105 except as modified by these Specifications. Wrap polyethylene encasement loosely around the pipe, fittings, and couplings, and secure with 2 inch wide polyethylene adhesive tape. Cover joints or seams in the polyethylene encasement using 2 inch wide polyethylene adhesive tape. The polyethylene encasement need not be watertight, but do not expose any part of the pipe or coupling to the backfill. Exercise care during backfilling to prevent puncturing or otherwise damaging the polyethylene encasement.

(b) Connections - When connecting to existing polyethylene-encased pipe, cut the existing encasement within 1 foot of the connection couplings or fittings. After the connections are made, overlap the exiting polyethylene encasement a minimum of 3 feet and seal the overlaps with 2 inch wide polyethylene adhesive tape.

01140.44 Thrust Restraint:

(a) Concrete Thrust Blocks - Place concrete thrust blocks as shown, at bends, tees, dead ends, and crosses. Pour concrete thrust blocks in place against solid, undisturbed earth at the sides and bottom of the trench excavation. Shape the blocks so as not to obstruct access to the joints of the pipe or fittings.

(b) Restrained Joints - Where indicated or approved by the Engineer, restrain joints at bends, tees dead ends, crosses, and all pipe joints within the indicated or specified distance on each side of the bends, tees, dead ends, and crosses. Install joint restraint systems according to the manufacturer's recommendations.

01140.45 Marking Tape and Wire:

(a) Installation - Install marking tape and wire over all nonmetallic water lines, including service connections. Place a continuous solid copper wire along the top of all water pipe, including service lines. Secure to the top of the pipe at maximum 10 foot intervals using 6 inch strips of 2 inch wide duct tape. Tie all splices and make them electrically continuous and waterproof. Provide access to terminal ends of the wire at all valve boxes, meter boxes, fire hydrants, and vaults. The result of this installation shall be a continuous wire circuit electrically isolated from ground. Place the marking tape approximately 1 foot above the top of the pipe for its full length.

(b) Accessibility - Make ends of wire accessible in water meter boxes, valve boxes or casings, or outside the foundation of buildings where the pipe enters the building. Provide wire access at locations no more than 1,000 feet apart.

(c) Testing - Test for continuity and isolation from ground in the wire after all work has been completed on the test section. Perform intermediate testing after backfilling operations and prior to surface restoration work. Test continuity between access locations by use of a temporary wire connecting test points in-line with an ohmmeter. Measure resistance with an approved ohmmeter that has been properly calibrated. The continuity of a test section will be accepted if the resistance of the test section does not exceed 5 ohms for each 500 feet of location wire being tested. Measure isolation from ground with an approved 1000 volt Megger, applied for 1 minute. The isolation of a test section will be accepted if the isolation resistance of the test section is at least 10 megohms. Locate and repair all breaks or defects in the wire and re-test until specified results are obtained.

01140.46 Blowoff Assemblies - Construct blowoff assemblies as shown and at the locations shown.

01140.47 Connections to Existing Mains - Make necessary arrangements with the Engineer in advance of connections to existing water mains. Assemble all materials, equipment and labor necessary to properly complete the work before starting.

(a) Notification - If the connection to the existing system involves turning off the water, notify the residents affected by the shutoff. The Engineer will advise which property owners are to be notified.

(b) Permission - The work to perform the connection may need to be carried out during times other than normal working hours. Do not operate any valves on the existing system without specific permission of the Engineer.

(c) Connection Arrangements - Piping arrangements shown are suggestions. For connection by any other arrangement, furnish a detailed sketch for approval not less than 2 weeks prior to the expected construction.

(d) Uninterrupted Service - Once work is started on a connection, proceed continuously without interruption, and as rapidly as possible, until completed. Shutoff of mains will not be allowed overnight, over weekends, or on holidays.

(e) Cutting Main Lines - Cut existing water mains according to 01140.12. Remove the portions of pipe to provide for the installation of the required fittings at the points of connection. Repair all damage to existing joints in piping to remain in-service. Determine the exact length of the existing water main that is to be removed. Bevel pipe ends to prevent damage to the transition coupling gasket during installation of the coupling. Clean the exterior of the existing pipe end to a sound, smooth finish before installation of the coupling.

01140.48 Maintaining Service:

(a) Service Transfer - Where existing services are to be transferred from old to new mains, plan and coordinate the work with that of the Utility so that service will be resumed with the least possible inconvenience to the public.

(b) Connections by Utility - Allow the Utility to make connections into the new pipe at such locations as the Utility may elect to supply customers with water, after the affected section of pipe has passed hydrostatic and bacteriological tests. The installation of any such connections by the Utility shall not be construed as an acceptance by the Agency of any part of the work required under the Contract.

01140.49 Backfilling - After the pipe is installed and inspected, backfill the trench according to Section 00405.

Field Testing

01140.50 Filling and Flushing - Fill pipes slowly with potable water at a maximum velocity of 1 foot per second while venting all air. Take all required precautions to prevent entrapping air in the pipes.

(a) Flush and Disinfect - Flush sections of pipe to be tested and disinfect to remove any solids or contaminated material that may have become lodged in the pipe. If no hydrant is installed at the end of the main, provide a tap large enough to develop a velocity of at least 2.5 feet per second in the main.

(b) Taps - Provide taps for temporary or permanent release of air, flushing, or chlorination.

(c) Disposal of Treated Water - Dispose of treated water flushed from mains. Neutralize the waste water for protection of aquatic life in the receiving water before disposal into any natural drainage channel. Dispose of disinfecting solution to the satisfaction of the Engineer and local authorities. If approved by the Engineer and the Utility, disposal may be made to any available sanitary sewer provided the rate of disposal will not overload the sewer.

01140.51 Hydrostatic Testing:

(a) General - Test all water mains and appurtenances in sections of convenient length under a hydrostatic pressure equal to one and one-half times the working pressure, but at least 150 psi, measured at the highest point of the test section. Furnish and operate all pumps, gauges, plugs, saddles, corporation stops, miscellaneous hose and piping, and measuring equipment necessary for performing the test. Provide certifications of accuracy for gauges used in the test from an approved laboratory.

(1) Backfill - Backfill the pipeline sufficiently to prevent movement of the pipe under pressure. Place all thrust blocks and allow time for the concrete to cure before testing. Where permanent blocking is not required, furnish and install temporary blocking and remove it after testing.

(2) Filling Pipe - Fill the mains with water and allow to stand under pressure a sufficient length of time to allow the escape of air and to allow the lining of the pipe to absorb water. The Agency will furnish the water necessary to fill the pipelines for testing, at a time of day when sufficient quantities of water are available for normal system operation.

(3) Time Test - Test by pumping the main up to the required pressure for at least 2 hours. Provide additional pumping during the test period to continuously maintain pressure within 5 psi of that required. During the test, observe the section being tested to detect any visible leakage. Use a clean container to hold water for pumping up pressure on the main being tested. Sterilize this makeup water by adding chlorine to a concentration of 25 ppm.

(4) Measure Quantity - Accurately determine the quantity of water required to maintain and restore the required pressure at the end of the test period by pumping through an approved positive displacement water meter.

(5) Loss Formula - The quantity of water lost from the main shall not exceed the number of gallons per hour determined by the formula:

$$L = \frac{SD(P)^{\frac{1}{2}}}{148{,}000}$$

Where:

L = allowable leakage in gallons per hour
S = length of pipeline tested in feet
D = nominal diameter of the pipe in inches
P = average test pressure during the leakage test in psi

(6) Pressure Loss - There shall be no appreciable or abrupt loss in pressure during the test period.

(7) Leakage - Correct all visible leakage regardless of the allowable leakage specified above. If the actual leakage exceeds the allowable amount, locate and repair the leaks and retest the pipeline.

(8) Use of Hydrant Valves - Make all tests with the hydrant auxiliary gate valves open and pressure against the hydrant valve. After the pipe test has been completed, test each gate valve in turn by closing it and relieving the pressure beyond. This test of the gate valve will be acceptable if there is no immediate loss of pressure on the gauge when the pressure beyond the valve is relieved. Verify that the pressure differential across the valve does not exceed the rated working pressure of the valve.

(9) Test Section Length - Limit sections to be tested to 1,500 feet, unless longer test sections are approved. The Engineer may require that the first installed section of pipe installed by each crew, not less than 1,000 feet in length, be tested. Do not continue pipe laying more than an additional 1,000 feet until the first section has been tested successfully.

(10) Test Equipment Readiness - Prior to calling out the Engineer to witness the pressure test, set up all equipment completely ready for operation and successfully perform the test to ensure that the pipe is in a satisfactory condition.

(11) Defective Materials or Workmanship - Replace defective materials or workmanship discovered during hydrostatic field testing. Whenever it is necessary to replace defective material or correct the workmanship, repeat the hydrostatic test until a satisfactory test is obtained.

(b) Testing Extensions from Existing Mains:

(1) Exceptions - When an existing water main is extended with new pipe to a new valve, and the distance from the existing pipe to the new valve is 18 feet or less, no hydrostatic test will be required if the section of new pipe between the new valve and the end of the existing main is installed with pretested, prechlorinated pipe. When the required hydrostatic tests are conducted in the new main section beyond the installed new valve in the closed position, the normal pressure of the existing main may be present against the other side of the new valve.

(2) Required Testing - Where the distance between the end of an existing water main pipe extension and the new valve is more than 18 feet, do not connect the new pipe to the existing pipe until after hydrostatic tests have been made to the required pressure in both directions against the new valve. Test after installing a temporary cap or plug on the end of the new pipe, beyond the new valve, as close as possible to the existing pipe. Make the final connection to the existing main with pretested, prechlorinated pipe.

(c) Testing Sections with Hydrants Installed - When hydrants are included with the section of main pipe to be tested, conduct three separate tests as shown in the following table:

	Water Main Gate Valves	Hydrant Auxiliary Gate Valves	Hydrant Operating Stem Valves	Hose Ports
Test No. 1	Closed	Closed	Wide Open	Wide Open
Test No. 2	Closed	Wide Open	Closed	Wide Open
Test No. 3 [1]	–	Closed	Wide Open	Closed

[1] Test each hydrant to the required test pressure. When testing a hydrant singly, pressure in the supply main beyond the hydrant auxiliary gate valve shall be 25 psi.

(d) Testing Hydrants Installed on Existing Mains - For hydrants installed and connected to existing mains, install the hydrant connection, including hydrant tee, connection pipe and auxiliary gate valves, with pretested materials.

Before the hydrant connection is made to the existing main, subject the hydrant installation to hydrostatic Test No. 3 in 01140.51(c).

01140.52 Disinfecting:

(a) General - Before placing new water mains in service, chlorinate new mains and repaired portions of, or extensions to, existing mains and obtain a satisfactory bacteriological report.

The initial chlorine content of the water shall be not less than 25 ppm. A chlorine residual of not less than 10 ppm shall remain in the water after standing 24 hours in the pipe.

(b) Chlorine Application - Apply chlorine by one of the following methods:

(1) Gaseous Chlorine - Apply a chlorine gas-water mixture by means of a solution-feed chlorinating device, or feed the dry gas directly through proper devices for regulating the rate of flow and providing effective diffusion of the gas into the water within the pipe being treated. Chlorinating devices for feeding solutions of the chlorine gas, or the gas itself, shall provide means for preventing the backflow of water into the chlorine.

(2) Calcium Hypochlorite - Apply a mixture of water and high-test calcium hypochlorite (65 - 70 percent Cl). First mix the dry powder as a paste and then thin to a 1 percent chlorine solution by adding water to give a total quantity of 7.5 gallons per pound (water to dry powder).

(3) Sodium Hypochlorite - Apply sodium hypochlorite, commercial grade (12.5 percent Cl) or in the form of liquid household bleach (5 - 6 percent Cl). This liquid chlorine compound may be used full strength or diluted with water.

(c) Point of Application - Apply the chlorinating agent at the beginning of the pipeline extension or any valved section of it, through a corporation stop inserted in the horizontal axis of the pipe. Supply the water injector for delivering the chlorine-bearing water into the pipe from a tap on the pressure side of the gate valve controlling the flow into the pipeline extension. Alternate points of applications may be used when approved.

(d) Rate of Application - Control water from the existing distribution system, or other source of supply, to flow very slowly into the newly laid pipeline during application of the chlorine. The rate of chlorine application shall be in such proportion to the rate of water entering the newly laid pipe that the initial chlorine content of the water will be at least 25 ppm.

(e) Cross Connection Control - Make no connections between the existing distribution system and non-disinfected pipelines constructed under this Contract, unless a State Health Division approved backflow preventer is installed in the connecting line.

(f) Retention Period - Retain chlorinated water in the pipe at least 24 hours. After this period, the residual chlorine at pipe extremities and at other representative points shall be at least 10 ppm.

(g) Chlorinating Connections to Existing Water Mains - Follow the chlorinating procedure specified in AWWA Standard C651. Liberally treat the trench and exterior of existing main with hypochlorites. Swab or spray the interior of all closure fittings with a 1 percent hypochlorite solution. Disinfect the existing main with a 100 ppm chlorine solution for 3 hours or a 300 ppm chlorine solution for 15 minutes and then thoroughly flush the line.

(h) Flushing and Testing - Following the retention period, flush all chlorinated water from the newly laid pipe until the replacement water throughout its length shows, upon test, an absence of chlorine or a residual no greater than that normally found in the source of supply.

(1) Sampling Tap - Install a sampling tap ahead of the flushing hose for convenient sanitary sampling.

(2) Service Resumption - Do not place the lines into service before a satisfactory report is received from the local or State health department on samples collected from representative points in the new system. Samples will be collected and bacteriological tests obtained by the Engineer.

(i) Repetition of Chlorinating and Testing - If the initial treatment results in a chlorine residual of less than 10 ppm at the end of the retention period or an unsatisfactory bacteriological test, repeat the original chlorination procedure until satisfactory results are obtained.

Measurement

01140.80 Measurement - The quantities of potable water pipe and fittings will be determined as follows:

(a) Pipe, Fittings and Couplings - The quantities of pipe of the various kinds, types, sizes and backfill classes will be measured on the length basis and will be horizontal measurement along the top of the finished trench, with no deduction for fittings, valves, and couplings.

In addition to measurement of the pipe, an allowance of 12 pipe diameters will be made for each factory-fabricated bend, sleeve, reducer or coupling, and an allowance of 18 pipe diameters of the larger diameter pipe will be made for each factory-fabricated tee or cross. The allowance will be added to the quantity for pipe of the same diameter.

(b) Extra Trench Excavation - The quantities of removal and backfill of extra trench excavation will be measured on the volume basis for each backfill class. The backfill classes are defined in Section 00405. The depth will be the actual depth removed for the changed line or grade as directed. The width will be the actual width removed for the changed line or grade, but in no case will the measured width exceed the allowable widths specified in 00405.41(c).

(c) Blowoff Assemblies - The quantities of blowoff assemblies will be measured on the unit basis.

(d) Connections to Existing Mains - The quantities of connections to existing mains will be measured on the unit basis.

Trench resurfacing will be measured according to 00495.80.

Installation under pavement by tunneling, jacking, or boring methods will be measured according to 00406.80.

Valves will be measured according to 01150.80.

Payment

01140.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	**Unit of Measurement**
(a)	___ Inch Potable Water Pipe, Fittings and Couplings with Class ___ Backfill	Foot
(b)	___ Inch Potable Water Pipe, Fittings and Couplings with Restrained Joints and Class ___ Backfill	Foot
(c)	Extra Trench Excavation with Class ___ Backfill	Cubic Yard
(d)	Blowoff Assembly, ___ Inch	Each
(e)	____ Inch Connection to ____ Inch Existing Main	Each

The Contract unit price for the appropriate pay items reflects plan requirements or the Contractor's choice from the applicable options listed on the Pipe Data Sheets if shown.

In items (a) and (b), the nominal diameter of pipe, fittings and couplings will be inserted in the first blank. The class of backfill will be inserted in the second blank. The quantities include the pipe plus the allowance for the fittings and couplings.

In item (c), the class of backfill will be inserted in the blank.

In item (d), the nominal diameter of assembly will be inserted in the blank.

In item (e) the nominal diameter of pipe will be inserted in the first blank and the nominal diameter of the main line will be inserted in the second blank.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

Trench resurfacing will be paid for according to 00495.90.

Installation under pavement by tunneling, jacking or boring methods will be paid for according to 00406.90.

Valves will be paid for according to 01150.90.

No separate or additional payment will be made for:

- trench excavation
- bedding
- pipe zone material
- backfill work
- polyethylene encasement
- concrete thrust blocks
- detectable marking tape and wire
- flushing, hydrostatic testing and disinfection, and water for testing
- exposing and cleaning existing mains, cutting and removing existing pipe, draining existing mains, disinfecting existing mains, and refilling existing mains

Section 01150 - Potable Water Valves

Description

01150.00 Scope - This work consists of furnishing and installing valves in potable water systems at the locations shown or at other locations as directed.

Materials

01150.10 Materials - Furnish materials meeting the following requirements:

Backflow Prevention Devices 02480.70
Ball Valves 02480.23
Butterfly Valves 02480.22
Combination Air Release/Air Vacuum Valves 02480.60
Commercial Grade Concrete in Precast Concrete Blocks 00440
Commercial Grade concrete in Thrust Blocking 00440
Gate Valves 02480.20
Hydraulic Cushion Check Valves ..... 02480.40(c)
Hydraulically Operated Valves 02480.50
Power-Actuating Devices 02480.24
Spring-Loaded Plug or Disc Check Valves ..... 02480.40(b)
Swing Check Valves ..... 02480.40(a)
Tapping Sleeve and Valve Assemblies 02480.30
Valve Boxes 02480.25
Valve Stem Extensions 02480.26

01150.11 Handling - Handle valves so as to prevent damage to the valve, lining or coating. Load and unload valves using hoists and slings so as to avoid shock or damage, and under no circumstances allow them to be dropped or skidded. Damaged valves will be rejected. If damage is confined to the coating or lining, it may be repaired in a manner satisfactory to the Engineer. Immediately place all damaged valves apart from the undamaged and remove the damaged valves from the site as soon as possible.

01150.12 Connecting Ends - Furnish valves with connecting ends as shown and as required for connection to pipe and fittings furnished.

Construction

01150.40 General - Install valves according to the plans and the manufacturer's recommendations. Join to the pipe according to Section 01140 and AWWA Standards for the type of connecting ends furnished. Thoroughly clean and repair joints prior to installation.

(a) Valve and Valve Box Installation - Set valves and valve boxes plumb. Install valve stem extensions when required. Center the valve box over the operating nut of the valve. Place valve boxes over the valve or valve operator so that the valve box does not transmit shock or stress to the valve. Install the lower casting of the unit first, supported by backfill or by a closed-cell foam collar not less than 2 inches in thickness. Do not allow the casting to rest directly on the body of the valve or on the water main.

(b) Valve Operator Extensions - Install a valve operator extension with rock guard on any valve that has the valve nut operator installed 4 feet or more below finish grade. Hot-dip galvanize extensions after fabrication.

(c) Backfilling - Backfill around valves according to Section 00405. Carefully tamp backfill around the valve box to a distance of 3 feet on all sides or to the undisturbed face of the trench, whichever is closer. Set the cast iron valve box cover flush with the roadbed or finished paved surface.

01150.41 Combination Air Release/Air Vacuum Valves - Install combination air release/air vacuum valves as shown. Slope all piping to permit escape of any entrapped air. Perform trenching and backfilling according to 01170.40 and Section 00405.

01150.50 Field Testing - After installation, operate valves from full open to full closed to make sure valves do not bind during operation. Correct all malfunctions in the operation of the valves. Verify the number of turns from full open to full closed and provide to the Engineer for the Agency's records.

01150.51 Hydrostatic Testing - Subject valves to hydrostatic testing according to 01140.51. Correct all defects in design, materials or workmanship to the satisfaction of the Engineer.

01150.52 Disinfecting - Disinfect valves according to 01140.52.

Measurement

01150.80 Measurement - The quantities of valves will be measured on the unit basis.

Payment

01150.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	**Unit of Measurement**
(a)	____ Inch ____ Valve	Each
(b)	____ Inch ____ Valve With ____ Actuator	Each
(c)	____ Inch ____ Check Valve	Each
(d)	____ Inch ____ Backflow Prevention Assembly	Each
(e)	____ Inch Hydraulically Operated Valve	Each
(f)	____ Inch Combination Air Release/Air Vacuum Valve Assembly	Each
(g)	____ Inch Tapping Sleeve and ____ Inch Valve Assembly	Each

In items (a) through (f), the size of the valve or assembly will be inserted in the first blank.

In items (a) through (d), the type of valve, check valve, or assembly will be inserted in the second blank.

In item (b), the type of actuator will be inserted in the third blank.

In item (g), the size of tapping sleeve will be inserted in the first blank. The size of valve assembly will be inserted in the second blank.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

No separate or additional payment will be made for earthwork not covered under other pay items, jointing, blocking of valves, protective coatings, valve boxes, valve stem extensions, and hydrostatic testing.

Section 01160 - Hydrants and Appurtenances

Description

01160.00 Scope - This work consists of furnishing and installing dry-barrel fire hydrants and appurtenances in potable water systems at the locations shown or at other locations as directed.

Materials

01160.10 Materials - Furnish materials meeting the following requirements:

Auxiliary Gate Valves	02480.20
Commercial Grade Concrete in Thrust Blocking	00440
End Connections	02485.20
Fire Hydrants	02485.10
Guard Posts	02485.70
Hydrant Dimensions	02485.30
Hydrant Extensions	02485.40
Tie Rods	02485.60
Traffic Flange	02485.50
Valve Boxes	02480.25
Valve Stem Extensions	02480.26

01160.11 Handling of Hydrants:

(a) Loading and Unloading - Handle hydrants to prevent damage to the hydrant, lining or coating. Load and unload hydrants using hoists and slings so as to avoid shock or damage, and under no circumstances allow them to be dropped, skidded or rolled against other hydrants. Damaged hydrants will be rejected. If damage is confined to the coating or lining, it may be repaired in a manner satisfactory to the Engineer. Immediately place all damaged hydrants apart from the undamaged and remove the damaged hydrants from the site as soon as possible.

(b) End Caps - Provide factory applied end cap on pipe connection end. Maintain end cap through shipping, storage, and handling to prevent damage and prevent dirt and moisture from entering the hydrant.

Construction

01160.40 Setting Hydrants - Inspect all hydrants upon delivery in the field to ensure proper working order. Provide a minimum 5 foot radius unobstructed working area around all hydrants. Set the traffic flange 2 inches above finish grade. Allow the hydrant barrel drain to waste into a pit of porous gravel material situated at the base of the hydrant.

(a) Touchup Painting - After all installation and testing is complete, paint the exposed portion of the hydrant with one coat of the type and color coating designated by the Engineer.

(b) Out-of-Service Hydrants - Identify all hydrants not in service by covering with a burlap or plastic bag properly secured.

01160.41 Hydrant Laterals - Install hydrant laterals, consisting of 6 inch ductile iron pipe, from the auxiliary gate valve at the main to the hydrant, according to Section 01140 and as shown.

01160.42 Hydrant Restraints - Restrain the thrust created in the hydrant lateral as shown. If applicable, clean tie rods after installation and paint with two coats of coal tar epoxy or other approved bituminous coating.

01160.43 Auxiliary Gate Valves and Valve Boxes - Install auxiliary gate valves and valve boxes according to Section 01150, except that the end connections shall be provided with lugs for tie rods, or the bells shall provide sufficient clearance between the body of the valve and the hub to permit the installation of tie rods.

01160.44 Hydrant Guard Posts - Construct hydrant guard posts at the locations shown. Excavate holes 6 inches in diameter for hydrant guard posts to a depth of 36 inches. Install hydrant guard posts plumb, and center in the holes. Backfill the holes and fill the hydrant guard posts with commercial grade concrete. Paint the exposed portion of each guard post with one coat of the type and color coating designated by the Engineer.

01160.45 Resetting Existing Hydrants:

(a) Relocation - Where existing hydrants are shown for adjustments to conform to a new street alignment or grade, or both, relocate the hydrant without disturbing the location of the hydrant lateral tee at the main.

(b) Thrust Restraint - Determine the method for thrust restraint for the hydrant lateral according to the conditions found in the field, and construct as directed.

01160.46 Moving Existing Hydrants - Move existing hydrants where shown. When the existing hydrant lateral tee does not accommodate a new hydrant location, install a new hydrant lateral tee in the main. Remove the existing hydrant lateral tee from the main if the main is to remain active, and insert a new section of pipe into the water main in place of the existing hydrant lateral tee. Where the existing main to which the existing hydrant lateral tee is connected is to be abandoned or temporarily activated after the existing hydrant is moved, plug the open end of the hydrant lateral pipeline. Provide temporary thrust restraint if temporarily reactivated.

01160.47 Reconnecting Existing Hydrants - Reconnect existing hydrants where shown. Leave the location and elevation of the existing hydrant unchanged, but change the existing hydrant lateral to connect with a new auxiliary gate valve and hydrant tee provided in a new main. Install new hydrant lateral according to Section 01140 where the lateral extends to connect to the new main. Where existing hydrants were not restrained with tie rods to the old main, restrain the new connections with tie rods as shown, or by other joint restraint method as directed.

01160.48 Hydrant Extensions - Install hydrant extensions where required. Set the traffic flanges a minimum of 2 inches and a maximum of 6 inches above finish grade.

Field Testing Installations

01160.50 General - After installation, operate hydrants from full open to full closed to make sure they do not bind during operation. Correct all malfunctions in the operation of the hydrants.

01160.51 Hydrostatic Testing - Subject hydrants to hydrostatic testing according to 01140.51. Correct all defects in design, materials or workmanship to the satisfaction of the Engineer.

01160.52 Disinfecting - Disinfect hydrants according to 01140.52.

Measurement

01160.80 Measurement - The quantities of work performed under this Section will be measured on the unit basis.

New pipe for hydrant connections to existing mains and lateral tees will be measured according to 01140.80.

Payment

01160.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	Unit of Measurement
(a)	Hydrant Assemblies	Each
(b)	Resetting Existing Hydrants	Each
(c)	Moving Existing Hydrants	Each
(d)	Reconnecting Existing Hydrants	Each
(e)	Hydrant Guard Posts	Each
(f)	Hydrant Extensions	Each

Item (a) includes auxiliary gate valves, tie rods, concrete blocks, gravel, and painting.

Item (b) includes tie rods, painting, and reconnecting to the main.

Item (c) includes new hydrant lateral tee, tie rods, painting, reconnecting to the main, and plugging abandoned laterals if needed.

Item (e) includes excavation, backfill, and painting.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.

New pipe for hydrant connections to existing mains and lateral tees will be paid for according to 01140.90.

Section 01170 - Potable Water Service Connections, 2 Inch and Smaller

Description

01170.00 Scope - This work consists of furnishing and installing service connections, 2 inch in diameter and smaller, from the main to the water meter, and furnishing and installing sampling stations. The water meter will be furnished and installed by others unless specified otherwise in the Special Provisions or on the plans.

Materials

01170.10 Materials - Furnish materials meeting the following requirements:

Bronze Nipples and Fittings 02490.60
Copper Tubing Service Pipe ..... 02490.40(a)
Corporation Stops 02490.30
Meter Boxes 02490.70
Meter Setters.....02490.50
Polyethylene Tubing Service Pipe..... 02490.40(b)
Saddles 02490.20
Sampling Stations 02490.80
Service Fittings.....02490.40(c)

Construction

01170.40 General - Make all service connections to water mains, except to ductile iron pipe, Thickness Class 52 or thicker, using saddles as specified and of the size and type suitable for use with the water main and the pipe being installed. Direct tap ductile iron pipe, Thickness Class 52 or thicker, for corporation stops according to the recommendations of the Ductile Iron Pipe Research Association (DIPRA), unless direct taps are prohibited by the Special Provisions. Install service pipelines perpendicular to the main, unless shown otherwise.

(a) Trench Depth - Construct the depth of trench for service connection piping to provide a minimum of 30 inches of cover over the top of the pipe. Exercise care to ensure that the main is not damaged by the work undertaken to install the service. Excavate and backfill for service connections according to Section 00405, except install the service pipeline under pavement, curbs and sidewalks by boring methods approved by the agency having jurisdiction over the roadway.

(b) Installation - Make service connections to water mains according to pipe manufacturer's recommendations and appropriate AWWA standard for water main installation. Cut service pipes using tools specifically designed to leave a smooth, even and square end on the pipe. Ream cut ends to the full inside diameter of the pipe. Clean pipe ends to be connected using couplings that seal to the outside surface of the pipe to a sound, smooth finish before the couplings are installed. Adjust the meter box to the finished grade after the surface has been acceptably restored.

01170.41 Reconnecting Existing Services - Where shown, reconnect existing service connections to the new mains. Verify the location of existing service connections in the field. Notify affected customers of the service interruption at least 24 hours prior to service interruption. Use insulating couplings at all connections between existing galvanized steel or iron pipe and new copper pipe. All fittings, appurtenances, and other miscellaneous materials on the sections of existing pipe that have been removed become the property of the Contractor.

01170.42 Sampling Stations - Install sampling stations according to the manufacturer's recommendations and at the locations and depths shown or as directed. Perform trenching and backfilling according to 01170.40.

Field Testing Installations

01170.50 Flushing and Disinfecting - For installation of service connections and sampling stations to existing water mains, liberally treat the trench and exterior of existing main with hypochlorites. Swab or spray all service pipe, appurtenances, and sampling stations with a 1 percent hypochlorite solution. Disinfect service connections and sampling stations with a 100 ppm chlorine solution for 3 hours or a 300 ppm chlorine solution for 15 minutes and then thoroughly flush the service connections and sampling stations. For installation of service connections and sampling stations concurrent with new water mains, flush and disinfect service connections and sampling stations according to Section 01140.

01170.51 Hydrostatic Testing - For installation of service connections and sampling stations to existing water mains, apply system pressure to new installation prior to backfilling and repair any visible leaks. For installation of service connections and sampling stations concurrent with new water mains, perform hydrostatic testing of service connections and sampling stations according to Section 01140. Correct all defects in materials or workmanship and retest until satisfactory results are obtained.

Measurement

01170.80 Measurement - The quantities of service connections, reconnecting existing services, and sampling stations will be measured on the unit basis.

Payment

01170.90 Payment - The accepted quantities of work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) ___ Inch Water Service Connections	Each
(b) Reconnecting Existing Water Services, ___ Inch	Each
(c) Water Sampling Stations	Each

In items (a) and (b), the size will be inserted in the blank.

Item (a) includes excavating, tapping the main, laying and jointing the pipe and fittings and appurtenances, backfilling, testing, flushing and disinfection of the service connection.

Item (b) includes excavation, tapping the main, laying and jointing the pipe and fittings and appurtenances, backfilling, testing, flushing and disinfection of the reconnected service connection.

Item (c) includes excavating, tapping the main, laying and jointing the pipe and fittings and appurtenances, backfilling, concrete pad, testing, flushing and disinfection of the sampling station.

Payment will be payment in full for furnishing and placing all materials, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified.